

**IV B.Tech II Semester Regular Examinations, Apr/May 2008
ROBOTICS**

(Computer Science & Engineering)

Time: 3 hours

Max Marks: 80

**Answer any FIVE Questions
All Questions carry equal marks**

1. Discuss the relative advantages and limitation of various generations of robots. [16]
2. (a) What is robot software? Discuss the software elements of robot and different teaching methods of robot.
(b) Discuss principle, limitations, applications and advantages of Fiber optics sensors. [8+8]
3. Discuss with an illustrative example for any one type of Robot, solution for inverse kinematics problem of Robot. Discuss algorithm to be deployed for solving multiple solutions. [16]
4. Explain the method of expressing the translational velocities of an object moving in space. [16]
5. Explain the Lagrange ? Euler's formulation for robot arm. [16]
6. Draw the block diagram of hybrid control system and explain briefly. [16]
7. (a) What are the important steps to be considered while designing Grippers used for handling Fragile objects?
(b) Explain the operation of optical encoder used in robot as a feed back device. [8+8]
8. With the aid of a sketch describe the specifications of degrees of freedom required on a robot wrist to be used in painting applications. [16]

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2. (a) What is robot software? Discuss the software elements of robot and different teaching methods of robot.
(b) Discuss principle, limitations, applications and advantages of Fiber optics sensors. [8+8]
3. Explain in detail the various interpretations of Homogeneous transformation matrix. [16]
4. Explain the method of expressing the rotational velocities of an object moving in space. [16]
5. Explain the Lagrange ? Euler's formulation for robot arm. [16]
6. Using the double axis rotation method, specify an orientation trajectory to bring the end effector from rest at the initial orientation as shown in figure 6, to a complete stop at the final orientation in 2 seconds. Adopt the interpolation by a quintic polynomial function of time. [16]

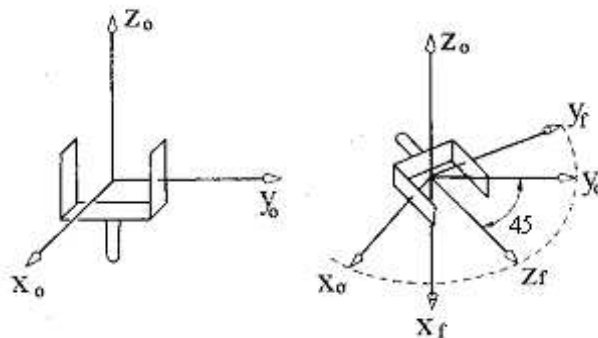


Figure 6

7. Discuss three different types of mechanical grippers used in industrial robots. [16]
8. What is robot vision? What are the types of vision sensors used to take the image of an object? [16]

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1. Describe the functions of the four basic types of a robot. [16]
2. (a) Explain the various capabilities and limitations of the robot languages.
(b) Explain the following sensors used in robots
 - i. Range sensor
 - ii. Proximity sensor [6+10]
3. Derive rotational transformation formula using vector techniques. [16]
4. Explain the method of expressing the rotational velocities of an object moving in space. [16]
5. Explain the Lagrange ? Euler's formulation for robot arm. [16]
6. Find the trajectory to transform the end effectors orientation from rest at the initial orientation shown in figure 6 to rest at time 1 second. Solve the problem by using single axis rotation method. [16]

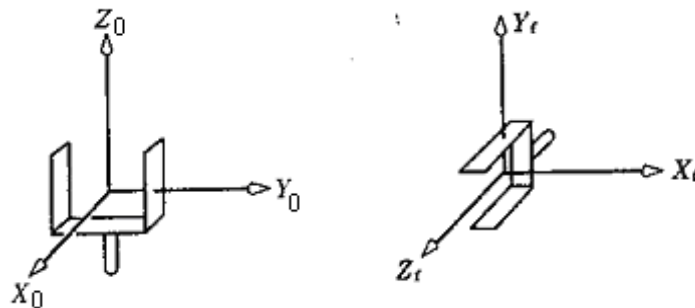


Figure 6

7. (a) Distinguish between mechanical and pneumatic grippers.
(b) With a neat sketch describe the working of an optical encoder. [8+8]
8. What is robot vision? What are the types of vision sensors used to take the image of an object? [16]

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1. Classify Robots illustrating their characteristics and applications. [16]
2. (a) Explain the various capabilities and limitations of the robot languages.
(b) Sketch and explain touch sensors and proximity sensors. [6+10]
3. Discuss any one method to solve problem of multiple solutions for inverse kinematics problem for Robot. [16]
4. Explain the method of expressing the translational velocities of an object moving in space. [16]
5. Derive the equations of motion for the two link manipulator in figure 5 using the Lagrangian formulation. Let l_{g1} be the distance between joint 1 and the center of mass of link 1, let m_i be the mass of link i , and let $\tilde{I}_i$ be the moment of inertia about the center of mass of link i . Assume that gravity acts vertically downward. [16]

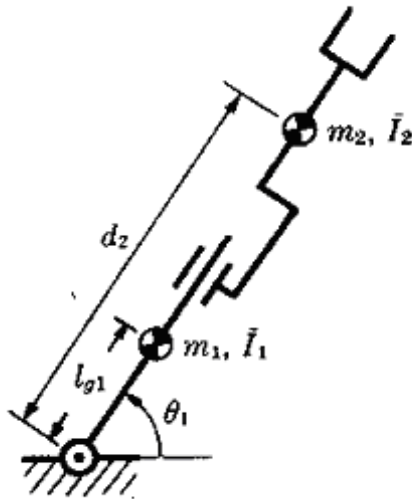


Figure 5

6. Discuss the basic structure of hybrid control system in the manipulator control system. [16]
7. Discuss three different types of mechanical grippers used in industrial robots. [16]

8. Explain the various techniques of image processing in the machine vision system.
[16]

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